

Type 2 Diabetes and Exercise
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Benefits of Exercise in Diabetes

- Lowers blood sugar. (50 mg/dl with 45" moderate)
- Lowers insulin resistance (greater with exercise than weight loss alone)
- Helps to control weight (10 fold increase in fat oxidation)
- Can result in decreased need for medications
- Improved control/A1c can reduce complications
- Improves circulation
- Improved mood, attitude and self-esteem

DIABETES PREVENTION TRIAL

- NIH sponsored 5 year trial involving 3234 subjects (completed ~2003)
- 32% Male and 68% Female
- Designed to test strategies to delay the development of DM in high risk IGT pts



Eligibility Criteria

- Minimum age 25
- BMI 24 or > (22 in Asian)
- FBS 95-125
- BG 140-199 2 hours post OGGT

Ethnic Populations

- Caucasian – 53.8-56.1%
- African American – 18.9-20.6%
- Hispanic – 15.1-16.5%
- Native American – 4.8-5.6%
- Asian – 3.4-5.3%

Placebo Group

- Placebo medication QD
- Placebo BID after one month
- Standard Lifestyle Recommendations
 - 20-30 minute individual session + handouts
 - Food Guide Pyramid / NCEP Step 1 diet
 - Increase Physical Activity

Metformin Group

- 850 mg QD
- 850 mg BID after one month
- Standard Lifestyle Recommendations
 - 20-30 minute individual session + handouts
 - Food Guide Pyramid / NCEP Step 1 diet
 - Increase Physical Activity

Intensive Lifestyle Group

- Achieve & Maintain 7% weight loss
 - Low calorie / low fat diet
 - 150 minutes exercise per week
 - 16 lesson curriculum taught 1 on 1
 - Monthly group or individual follow-up

DIABETES PREVENTION TRIAL

- DPP results released August 2001 (subjects were followed for 2.8 years) and published 2002
 - Metformin reduced progression 31%
(95%CI 17-43%)
Dose 850 mg BID
 - Lifestyle intervention reduced progression to diabetes 58%
(95% CI 48-66%)

Average Weight Loss by Group

- Placebo – 0.1 Kg
- Metformin – 2.1 Kg.
- Lifestyle Intervention – 5.6 Kg.

Incidence of Diabetes by Group

- Placebo – 28.9%
- Metformin – 21.7%
- Lifestyle Intervention – 14.4%

Exercise and Type 2 Diabetes Effects on Glycemic Control

- Meta-analysis of studies of structured exercise effect on A1c and body mass in Type 2 DM
 - Total of 504 subjects, exercise & control groups did not differ at baseline
 - Structured exercise intervention
 - A1c significantly lower (7.65% vs 8.31%)
 - Post intervention body weight not significantly different
 - Effect is not mediated by weight loss

Broule NG, JAMA 286:1218-1227, 2001

Exercise and Type 2 Diabetes Effects on Overall Mortality

- Aerobics Center Longitudinal Study
 - 1,263 men with diabetes, subsample of >20,000 men
 - Cardio-respiratory fitness classified on exercise testing as low, moderate or high
 - 42% of diabetic men were classified as “low fit”
 - 50% of diabetic men were classified as “inactive”

Wei M, et al, Ann Intern Med 132: 605-611, 2000

Exercise and Type 2 Diabetes Effects on Overall Mortality

- Results
 - 11.7 years mean follow up
 - 180 deaths
 - Low-fit men had 2.2 fold greater mortality risk
 - Mortality in moderately fit men was 60% lower
 - After adjustment for age, baseline CVD, hypercholesterolemia, BMI, HTN smoking and baseline FBS
 - Moderate exercise mean time was 150 minutes per week for men and 130 minutes for women

Wei M, et al, Ann Intern Med 132: 605-611, 2000

Resistance Exercise

- Dunstan et al.
 - 36 sedentary type 2, aged 60-80 yo
 - 6 months moderate weight loss and high intensity resistance training (3 sets of 8-10 reps at 75-80% of maximal)
 - Results
 - 1.2% reduction in A1c and additional decrease in meds
 - Lean body mass increased by 0.5 kg

Dunstan et al, Diabetes Care 25: 1729-1736, 2002

Resistance Exercise

- 62 Hispanic men (22) and women (40)
- Mean age 66 years
- 16 weeks, supervised high intensity resistance, 3 sets of 8 reps of 5 exercises, 3 times per week
- Results
 - 1% reduction in A1c & additional decrease in meds
 - Systolic BP mean decline of 9.7 mm Hg
 - Decline in free fatty acids

Castenada et al, Diabetes Care, 25: 2335-2342, 2002

Summary

- Exercise works! Both for pre-diabetes and type 2
- Increases insulin sensitivity and decreases insulin resistance
- Improves A1c
- Promotes weight loss
- Decreases Mortality

Evaluation Prior to Exercise Program

- Complete Physical Exam: including foot, respiratory, cardiovascular, HTN
- Complication screening
- Exercise stress EKG
 - Age >40 yo, with or without CVD risk factors other than diabetes
 - Age >30 years and
 - Type or or 2 DM of >10 yrs duration
 - Hypertension
 - Tobacco use
 - Proliferative or preproliferative retinopathy
 - Nephropathy, including microalbuminuria

Evaluation Prior to Exercise Program

Exercise Stress EKG

- Any of the following regardless of age
 - Known or suspected CAD, Cerebral Vascular disease and/or Peripheral Vascular disease
 - Autonomic neuropathy (thallium stress test)
 - Advanced nephropathy or renal failure

* Clinician "gut feeling"

Medical Conditions potentially Limiting Strenuous Exercise

- Hypoglycemic unawareness
- Proliferative Diabetic Retinopathy
- Persistent Hyperglycemia
- Uncontrolled Hypertension
- Significant Peripheral Sensory Neuropathy
- Autonomic Insufficiency
- Coronary Artery Disease
- Peripheral Vascular Disease
- Significant Proteinuria
- Nephropathy
- Non Adherence to medical regimen

Hyperglycemia / Hypoglycemia

- Delay exercise if BG >300 mg/dl or urine ketones
- Optimal time to exercise 1-3 hours post meal
- SMBG- before, during, after
- If BG is <80 consume 15-20 gms carb
- BG start goal range 100-200 mg/dl
- 15-20 grams carbs for prevention, may need additional every 30-60 minutes
- May need reduction in insulin dose 25-75%
- Post exercise hypoglycemia
- Individualize

Carbohydrate Sources equal to 15 grams

- ½ cup of regular soda
- ½ cup of orange, apple, grapefruit juice
- 2 tablespoons of sucrose dissolved in water
- 1 tube (15 gm) of Glutose 15
- 2 tablespoons of raisins
- 3 glucose tablets (5 gm each)
- 6-8 oz of milk
- 8-10 hard candies
- 1 cup Gatorade

Diabetes Complications and Exercise

- Retinopathy- need dilated exam
 - Normal or mild BDR, no restriction
 - Proliferative retinopathy- no strenuous or static
- HTN-
 - Exercise induced HTN: Peak systolic pressure 210 mm Hg men and 190 mm Hg women
 - Low static demand sports/exercise
 - Do need conditioning

Diabetes Complications and Exercise

- Nephropathy-
 - No evidence that exercise exacerbates fixed diabetic neuropathy
 - Can cause transient increase in urine protein excretion
 - Monitor microalbumin creatinine ratio annually and serum creatinine periodically
 - Diabetic nephropathy and retinopathy are linked

Diabetes Complications and Exercise

■ Neuropathies

- Peripheral sensory – do motor /sensory foot exam
 - Most common, injury can result from increased pain threshold / loss of sensation
 - Motor nerve dysfunction results in weakness – will not be able to build muscle mass
- Autonomic –
 - Determine BP and pulses response to orthostatic and Valsalva maneuvers
 - Gastroparesis

Exercise Program Components

■ Type

- Aerobic
- Strength or Resistance Training
- Flexibility
- Core

■ Frequency

- Fitness 3-5 times per week
- Weight loss 5-7 times per week
- No more than 72 hours between sessions

Exercise Program Components

■ Intensity

- 60-85% maximal heart rate
- 220 minus age
- Stress testing
- RPE

■ Time


- 20-60 minutes
- Start low / go slow
- Minimum of 150 minutes per week for weight loss

ACTIVITIES THAT I ENJOY

Walking	Water Aerobics	Running	Dancing
Biking	Swimming	Gardening	Golfing
Yoga	Step Aerobics	Tennis	Pilates
Others:			

New exercises I can do at home:

1. _____
2. _____
3. _____
4. _____
5. _____



Activities

- Pedometer and 10,000 steps
- Dancing to ethnic music
- Family walking
- Mall walking
- Indoor bike
- Video
- Snowshoeing
- Ice skating

Barriers to Exercise - Sharks

- Illness and physical limitations
- Lack of time
- Demands from family, friends, or job
- Inclement weather
- Boredom
- Lack of motivation

SET SMART GOALS

S-M-A-R-T
Specific, Measurable, Attainable,
Relevant, Time-based

BARRIERS IN MY LIFE PREVENTING ME FROM EXERCISING:

1. _____
2. _____
3. _____

HOW TO OVERCOME THOSE BARRIERS:


1. _____
2. _____
3. _____

CHANGING BEHAVIORS

Behavior I would like focus on changing: _____

Ways to change this behavior: _____

Benefits of changing this behavior: _____



My Fitness Goals

Goal 1: _____

Plan of Action: _____

Goal 2: _____

Plan of Action: _____

Goal 3: _____

Plan of Action: _____

Keep It Going

- Time to gain a habit
- Have a set time (am greater success)
- Maintain while on vacation or sick
- Journal or log
- Someone to do it with!

■ Additional References:

- Sigel R., et al. Physical Activity/Exercise and Type 2 Diabetes, Diabetes Care 27: 2518-2539, 2004.
- Hornsby W., et al. Management of Competitive Athletes with Diabetes, Diabetes Spectrum 18: 102-107, 2005.
- Mullooly C., et al. Diabetes Educators and the Exercise Prescription, Diabetes Spectrum 18: 108-113, 2005.
- Kriska A., et al. Fishes, Whales and Fishing Tips: Hooking an Active Lifestyle, Diabetes Spectrum 18: 114-118.

